

***Denhamia megacarpa* J.J.Halford & Jessup and *D. peninsularis* J.J.Halford & Jessup (Celastraceae), two new species from Queensland**

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Summary

Halford, J.J. & Jessup L.W. (2020), *Denhamia megacarpa* J.J. Halford & Jessup and *D. peninsularis* J.J. Halford & Jessup (Celastraceae), two new species from Queensland. *Austrobaileya* **10(4): 594–603**. Two new species of *Denhamia* Meisn. are described, viz. *D. megacarpa* J.J.Halford & Jessup, *D. peninsularis* J.J.Halford & Jessup, and the new combination, *D. muelleri* (Benth.) Jessup is made based on *Celastrus muelleri* Benth. The two new species are illustrated and notes are provided on distribution, habitat and conservation status. An identification key to Australian *Denhamia* is provided.

Key Words: Celastraceae; *Denhamia*; *Denhamia megacarpa*; *Denhamia muelleri*; *Denhamia peninsularis*; Australia flora; Queensland flora; taxonomy; identification key; conservation status

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Introduction

The genus *Denhamia* Meisn. (Celastraceae) consists of 15 species of trees and shrubs distributed across Australia and the western Pacific. Following inference based on molecular and morphological studies (Simmons *et al.* 2008), the genus has been expanded to incorporate the Austral-Pacific *Maytenus* Molina (McKenna *et al.* 2011), from which it was previously separated on locule and ovule numbers (e.g. Jessup 1984). Thirteen species occur in Australia with ten occurring in Queensland.

In this paper we describe two new species of *Denhamia* from Queensland, Australia, that have capsular fruit with 2–5 locules and 2–10 ovules, features on which the genus was originally circumscribed. *Denhamia megacarpa* has a highly restricted occurrence, known only from several isolated subpopulations from tablelands in central Queensland, whereas *D. peninsularis* is

restricted to northern Cape York Peninsula, Queensland. A key to Australian *Denhamia* is provided to demonstrate the characteristics that separate the newly described species from all others.

Simmons in McKenna *et al.* (2011) made an invalid combination in publishing the name *Denhamia ferdinandii* when an earlier epithet should have been used for this species. The correct new combination for this is made below.

Materials and methods

Dried and spirit collections were examined of the undescribed *Denhamia* species held at the Queensland Herbarium (BRI) and all closely related taxa. Measurements were made from dried material with the exception of floral components from which measurements were taken from material in spirit. Targeted field surveys for *D. megacarpa* were carried out at known locations and suitable habitat, on four separate occasions between May 2014 and April 2019 (see Halford 2019 for details) to supplement the morphological examinations.

Measurements are inclusive in the descriptions, i.e. 1.0–1.7 is given as 1–1.7. National Park is abbreviated as NP in the specimen citations.

Taxonomy

1. *Denhamia megacarpa* J.J.Halford & Jessup **sp. nov.** With affinity to *D. oleaster* (Lindl.) F.Muell., but differing by the longer, narrower leaves (5–12.5 × 0.5–2 cm) with a thick waxy cuticle on the lower surface, a more complex and expansive inflorescence and larger fruits (2.9–5.5 cm long). **Typus:** Queensland. LEICHHARDT DISTRICT: Mackenzie (tableland), c. 5 km along Karramarra Road from Willie Creek – Royles Road, 16 April 2019, J.J. Halford JJH635 & S. Bush (holo: BRI; iso: CANB, K).

Denhamia sp. (June Tableland T.J.McDonald 553); Jessup (1997: 45; 2002: 44; 2007: 44; 2010: 39); Jessup & Halford (2020).

Shrub or tree to 8 m tall, glabrous; the trunk white to pale grey, mottled, often becoming deeply fluted at the base; branchlets pendulous. Leaves coriaceous and stiff, with a thick, white, waxy cuticle below making them strongly discoloured; stipules linear-triangular, 0.2–0.5 mm long, caducous. Juvenile and coppicing leaves with petioles 0.2–0.4 cm long; lamina similar to adult form, but with distinctly toothed margins and a pungent tip, to 19.5 cm long and 0.8–1.5 cm wide. Adult leaves with petioles 0.3–1.3 cm long; lamina lanceolate, linear or falcate to narrowly elliptic, occasionally narrowly oblanceolate; venation obvious and distinctly raised on the upper side with numerous secondary veins and prominent reticulate tertiary veins, less so beneath and partly obscured by the cuticle, 5–12.5 cm long and 0.5–2 cm wide, margins entire to shallowly or occasionally toothed, gradually or abruptly drawn to a blunt or pungent tip, the mucro to 0.9 mm long where present. Inflorescence an axillary, many-flowered, compound cyme to 5.5 cm long; pedicels 4–11 mm long; flowers 5-merous; sepals semicircular, rounded or oblong and concave, 1–1.5 mm long; petals oblong-obovate and slightly convex, 4–5 mm long, cream to a pale greenish-yellow;

staminal filaments 1.5–2.5 mm long, anthers ± latrorse; ovary mostly exposed above disk, imperfectly 3 (rarely 2–4)-locular with 8–10 ovules per locule; style 1–1.5 mm long; stigma undivided or shortly 3-lobed. Capsules ovoid (rarely obovoid), elongated, 2.9–5.5 cm long and at least to 2.3 cm wide prior to dehiscence, ripening yellow; valves woody, 2–5 mm thick, the septa not touching axially, containing several seeds 5–6 mm long enveloped in a fleshy red aril. **Fig. 1.**

Additional selected specimens examined: Queensland. SOUTH KENNEDY DISTRICT: c. 5 km W of Newlands Mine, N of Glenden on Sutor North Station, Apr 2005, Harris WK1H2161 (BRI). LEICHHARDT DISTRICT: Eagle Point, June Tableland, N of Dingo, Oct 2002, Bean 19387 (BRI); June Tableland, 80 km N of Dingo, Jun 1972, McDonald 553 (BRI); June Tableland, NW corner, Nov 2015, Halford JJH444 & Bush (BRI); NW escarpment, June NP, North of Dingo, Feb 2006, Bean 24633 (BRI); June Tableland, NW corner, May 2014, Halford JJH356 & Williams (BRI); June Tableland, N of Dingo, Nov 1990, Bean 2621 (BRI); Mackenzie (tableland), c. 3 km along Coreen Road from Willie Creek – Royles Road, Apr 2019, Halford JJH634 & Bush (BRI); SE of Mackenzie River, Feb 1993, Fensham 446 (BRI); c. 50 km N of Dingo, s.dat., Bunn TRIK (BRI); Burkan, c. 11.75 km along Burkan Road, from turnoff at Alsace, Apr 2019, Halford JJH633 & Bush (BRI).

Distribution and habitat: *Denhamia megacarpa* is known from three subpopulations in eastern central Queensland, those being the tableland at the locality of Mackenzie, north of Dingo; the June Tableland near Middlemount where it was first recorded in 1972 and an outlying subpopulation at Newlands, west of Mackay (see **Map 1**). These three subpopulations are geographically isolated, confined to separate geological features that are in effect, ecological islands. The Mackenzie and June subpopulations are separated by a distance of approximately 50 km by the cleared and highly modified Mackenzie River floodplain. The Newlands subpopulation lies approximately 205 km north of the June subpopulation. These subpopulations are considered to be genetically isolated from each other (Halford 2019). Only the June subpopulation is currently protected within the reserve system (one location in June National Park, one location in June State Forest).

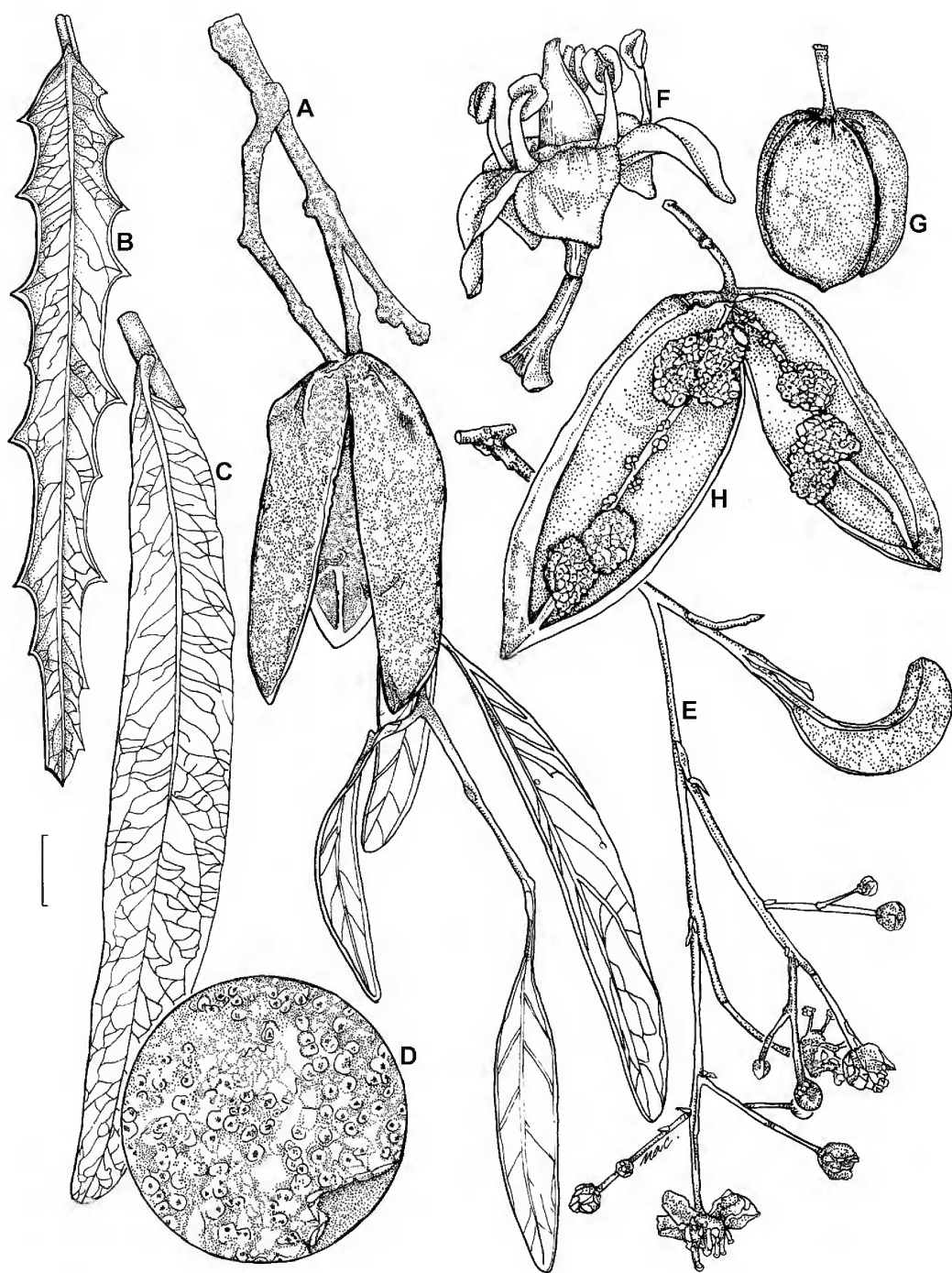


Fig. 1. *Denhamia megacarpa*. A. pendulous habit of branchlet with persistent dehiscent capsule $\times 1$. B. juvenile leaf $\times 1$. C. adult leaf $\times 1$. D. cuticle detail on abaxial side of leaf $\times 40$. E. inflorescence $\times 1.25$. F. flower $\times 5$. G. fruit (insect infested and failing to reach maturity) $\times 1$. H. dehiscent fruit with seed enclosed in aril $\times 1.25$. A from Halford JJH634 & Bush (BRI); B–D & G from Halford JJH356 & Williams (BRI); E from Halford JJH635 & Bush (BRI); F from Halford JJH444 & Bush (BRI); H from Bunn TRIK (BRI). Scale bar = 10 mm at $\times 1$ magnification. Del. N. Crosswell.

Denhamia megacarpa favours shallow, Cainozoic lateritic duricrusts on or near steep upper slopes at the edge of the tablelands in association with *Acacia shirleyi* Maiden and/or *A. catenulata* C.T.White (Regional Ecosystem (RE) 11.7.2, see Queensland Herbarium 2019 for description), or immediately adjacent upon the tablelands in woodland of *Eucalyptus crebra* F.Muell. and *Corymbia brachycarpa* (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson (RE 11.5.9b), usually on deeper Cainozoic sandplains. This habitat preference is strongly apparent at Junee Tableland where, based on current search effort, the species is confined to the north-west corner of the tableland. The Mackenzie subpopulation is the most populous (a density of *c.* three individuals per hectare where present) although this subpopulation maintains a patchy distribution with individuals clustered mostly adjacent to, and always within 1 km of the escarpment.

Phenology: Flowers have been recorded in November and April, while mature fruits have been recorded in February.

Notes: *Denhamia megacarpa* appears to be most similar to *D. oleaster* but differs from that species by having longer and narrower leaves (4–8 cm long and 1–3.5 cm wide in *D. oleaster*) with a very thick waxy cuticle on the lower surface; usually a more complex and more open inflorescence with more extensive and longer branches and longer pedicels (4–11 mm long in *D. megacarpa*, < 4 mm long in *D. oleaster*); and an elongated capsule to 5.5 cm long (to 2.8 cm long in *D. oleaster*) with a notably thick wall to 0.5 cm (to < 2 mm in *D. oleaster*).

Denhamia megacarpa occurs within the eastern extent of the widespread *D. oleaster* with that species favouring soils of higher clay content that support vegetation communities with more closed structures such as vine thickets and forests dominated by brigalow (*Acacia harpophylla* F.Muell ex Benth.). *D. megacarpa* appears to favour shallower sands and lateritic surfaces – the relatively

accentuated sclerophyllous composition of the leaf of *D. megacarpa* a likely adaptation to nutrient poor soils (Beadle 1966; Read & Sanson 2003) with the thick waxy cuticle on the abaxial leaf surface a possible adaptation to a more xeric environment (Schreiber & Riederer 1996) to that of *D. oleaster*. The two species have not been observed co-occurring (JJH pers. obs.).

Denhamia megacarpa also appears to be similar to *D. obscura* (A.Rich.) Meisn. ex Walp but differs mostly from that species by its longer and narrower leaves, particularly in the juvenile stage (to 15 cm long and 6 cm wide in *D. obscura*) and a thicker lamina with more prominent venation. *D. megacarpa* generally develops a more open inflorescence with pedicels 4–11 mm in length (1–3.5 mm in length within *D. obscura*), flowers with longer filaments (1.5–2.5 mm compared to < 1 mm in *D. obscura*) and a more pronounced style (1–1.5 mm in length compared to little or no style in *D. obscura*). Mature fruits of *D. megacarpa* are longer, more elongated and ovoid or obovoid (shorter, broader and more globose in *D. obscura*). The two species are allopatric with *D. obscura* occurring in the top end of the Northern Territory and adjacent northern Western Australia – the closest occurrence *c.* 1400 km north-west of *D. megacarpa*.

Denhamia megacarpa probably has naturally low fertility rates. This could in part be due to high levels of predation of buds, flowers and fruits by insect larvae, observed in the field and on preserved specimens. Despite the first collection of this taxon in 1972, a paucity of quality fertile herbarium material exists and only recently have flowering specimens been obtained. Recruitment is considered to be low with no juvenile plants observed during the most recent surveys.

Conservation status: Based on the IUCN (2012) criteria, this species has been nominated by Halford (2019), under the hispid name *Denhamia* sp. (Junee Tableland T.J.McDonald 553), as **Endangered** – EN A4 (a); B1&B2 a, b (iii, v); C1.

The overall population size for *Denhamia megacarpa* is estimated at < 1000 mature individuals. It is considered to be naturally rare with a highly fragmented population. The landscape within the extent of occurrence for *D. megacarpa* has been extensively modified for grazing and to a lesser extent, mining and cropping and as such, the subpopulations at Newlands and Mackenzie have been exposed to historic and ongoing threats of land clearing. Mining interests occur over the June State Forest and the tableland at the location of Mackenzie and mining activities are ongoing in the vicinity of the Newlands subpopulation. Despite a preference for xeric environments, *D. megacarpa* is sensitive to the effects of fire with high intensity fire resulting in mortality or crown death followed by coppicing from the lower trunk, with no suckering evident (JJH pers. obs.). Fires that are too frequent and/or high in intensity pose a serious threat (Halford 2019).

Etymology: The species epithet is given in reference to the fruits that are the largest known in the genus.

2. *Denhamia peninsularis* J.J.Halford & Jessup **sp. nov.** With affinity to *D. celastroides* (F.Muell.) Jessup, but differing by the stiffer and generally shorter and broader leaves, longer pedicels, shorter styles and larger fruits. **Typus:** Queensland. COOK DISTRICT: 16.8 km NE of Heathlands by road, 29 February 1992, J.R. Clarkson 9256 & V.J. Neldner (holo: BRI; iso: K).

Denhamia sp. (Jardine River B.P.Hyland 10250); Jessup (1997: 45; 2002: 44; 2007: 44; 2010: 39); Jessup & Halford (2020).

Denhamia sp. (Jardine River Mouth BH 10250); Hyland *et al.* (1994, 1999: 60).

Denhamia sp. (Jardine River Mouth); Cooper & Cooper (2004: 114).

Shrub or small tree to 5 m tall, glabrous, the trunk mottled grey; young branchlets subtly striate. Leaves alternate and often crowded near the ends of branchlets, coriaceous, stiff, discolourous; stipules linear-triangular, 0.25–0.3 mm long, caducous. Juvenile leaves with petiole 0.5–0.7 cm long; lamina to 11.5 cm

long and 4 cm wide, with shallowly toothed margins. Adult leaves with petiole 1.5–4 mm long; lamina oblanceolate to obovate (occasionally lanceolate to elliptic), rarely obcordate, attenuate at the base; venation raised on both surfaces with 8–14 secondary pairs, 3–9 cm long, 1.1–3.7 cm wide; margins serrate to serrulate, sometimes obscure, mucronate to (rarely) retuse. Inflorescence a many flowered cyme to 7 cm long, pedicels 1.7–3 mm long. Flowers 5-merous, sepals rounded to ovate and concave, entire or sometimes erose, occasionally cuspidate, 1–1.5 mm long; petals oblong-obovate to rounded, concave, occasionally cuspidate, 2.5–4 mm long, cream to a pale yellow in colour, staminal filaments 1.2–1.8 mm long, anthers latrorse, ovary mostly exposed above disk, imperfectly 3 (rarely 2–4)-locular with 2–4 ovules per locule, style 1.2–1.7 mm long, stigma 3-lobed. Capsules ovoid, to 1.6–2.4 cm long when mature and at least 14 mm wide prior to dehiscence, ripening through yellow to orange, valves woody, 1–2 mm thick, the septa not touching axially, containing several seeds 3–5 mm long, mostly enveloped in a fleshy red aril. **Fig. 2.**

Additional selected specimens examined: Queensland. COOK DISTRICT: Jardine River Mouth, Feb 1980, *Hyland 10250* (BRI); Turtle Head Island, May 1995, *Le Cussan 416* (BRI); Cape York, N of Jardine River c. 32 km SE of Bamaga, Oct 1971, *Dodson s.n.* (BRI [AQ003618]); Cockatoo Creek at Old Telegraph Line crossing, Mar 1992, *Clarkson 9328 & Neldner* (BRI); 91.3 km SSE of Bamaga, Oct 1993, *Fell DGF3674 & Dibella* (BRI); 5 km W of Shelburne Bay, 7 km NE of Red Cliffs, Cape York Peninsula, Jun 2008, *Forster PIF33873 & McDonald* (BRI); 3 km S of Shelburne Bay, 8 km W of Thorpe Point, Cape York Peninsula, Jun 2008, *Forster PIF33817 et al.* (BRI); Cape York Peninsula, Shelburne Bay area c. 1.5 km S from MacMillan River crossing track to White (Wolona) Point, Jul 1990, *Purdie 3700* (BRI); 6 km N of Olive River Mouth, Apr 1994, *Fell DGF4226 et al.* (BRI); N of Olive River Mouth, Sep 1974, *Tracey 14472* (BRI); Olive River, Sep 1974, *Hyland 7446* (BRI); 3.5 km from beach turnoff from Bolt Head on track to Bromley Station, Jul 1990, *Clarkson 8845 & Neldner* (BRI); Temple Bay, Bolt Head, Jun 1996, *Forster PIF19366* (BRI).

Distribution and habitat: *Denhamia peninsularis* is restricted to northern Cape York Peninsula from Bolt Head north to the Jardine River south of Bamaga (**Map 2**). It occurs at low elevations in dense shrublands



Fig. 2. *Denhamia peninsularis*. A. branchlet with inflorescence $\times 1.5$. B. juvenile leaf $\times 1$. C. adult leaf $\times 1$. D. flower $\times 8$. E. branchlet with fruit $\times 1$, partially dehiscent fruit $\times 2$. G. dehiscent fruit with seed enclosed in aril $\times 2$. A from *Le Cussan 416* (BRI); B from *Fell DGF3674 & Dibella* (BRI); C & G from *Dodson s.n.* (BRI [AQ003618]); D from *Forster PIF19366* (BRI); E from *Hyland 10250* (BRI). Scale bar = 10 mm at $\times 1$ magnification. Del. N. Crosswell.

or low forests as closed heaths (e.g. REs 3.3.53a, 3.5.42, 3.2.17 and 3.2.18), or simple notophyll vine forests and semi-deciduous microphyll vine thickets in coastal or riparian vegetation in siliceous white sands (e.g. REs 3.3.5a, 3.5.33 and 3.2.12).

Phenology: Flowers have been recorded in February, and May – July, while mature fruits have been collected in February, June, July and October.

Notes: *Denhamia peninsularis* closely resembles *D. celastroides* but the distributions of these species do not overlap. *Denhamia celastroides* occurs no further north than the Windsor Tableland, c. 500 km from the southern-most record of *D. peninsularis*. Furthermore, the habitats of the two species differ, with *D. peninsularis* occurring in sands in coastal and riparian vegetation at low altitudes (5–150 m), whereas, in its northern-most limits, *D. celastroides* is confined to higher altitude (600–1200 m) complex notophyll vine forests in granite derived soils. Morphologically these two species differ in their leaf texture and size (stiffer with a smaller lamina length to breadth ratio in *D. peninsularis*), their floral components (a longer pedicel and shorter style in *D. peninsularis*) and mature fruits (capsules

larger (1.6–2.4 cm) and ripening orange in *D. peninsularis*, while those of *D. celastroides* are 1–1.7 cm and ripen yellow). Other species of *Denhamia* that occur within the range of *D. peninsularis* are *D. cunninghamii* (Hook.) M.P.Simmons, *D. fasciculiflora* (Jessup) M.P.Simmons and *D. oleaster*, all of which are easily distinguished from each other based on the features outlined in the key below.

Conservation status: *Denhamia peninsularis* occurs in intact vegetation in a generally undeveloped region and is well represented within the reserve system, albeit with a limited extent of occurrence (6693 km²) and area of occupancy (52 km²) (derived using GeoCat: Bachman *et al.* 2011). A listing of **Least Concern** is therefore recommended for this species.

Etymology: The species epithet is given in reference to Cape York Peninsula, the location to where this species is confined.

3. *Denhamia muelleri* (Benth.) Jessup, **comb. nov.**; *Celastrus muelleri* Benth., *Fl. Austral.* 1: 399 (1863); *Maytenus ferdinandi* Jessup, *Fl. Aust.* 22: 223 (1984); *Denhamia ferdinandi* (Jessup) M.P.Simmons, *Syst. Bot.* 36: 929 (2011) *nom. inval.*; *non Maytenus muelleri* Schwacke.

Key to Australian *Denhamia* species (adapted from Jessup 1984):

- 1 Ovary perfectly 2 or 3-locular with ovules 2 per locule at base of septa; septa connate, touching axially in fruit; valves of capsules crustaceous (formerly in *Maytenus*) 2
1. Ovary perfectly or imperfectly 2–5-locular with ovules 2–10 per locule, not confined to base of septa; septa touching near apex, base connate but otherwise not touching in axially in fruit, valves of capsules mostly woody (*Denhamia* in the original sense) 7
- 2 Aril thick, restricted to base of seed 3
2. Aril thin, surrounding at least half seed 4
- 3 Flowers 4-merous, disc c. 1 mm diameter E Qld, NE NSW ***D. disperma***
3. Flowers 5-merous; disc c. 2.3 mm diameter N NT, N WA ***D. muelleri***
- 4 Flowers in fascicles. NE Qld ***D. fasciculiflora***
4. Flowers in racemes 5

- 5 Leaves bright green concolorous or rarely discolorous, margins always entire, not recurved. Qld, N NSW, NT and N WA **D. cunninghamii**
5. Leaves discolorous, grey-green below, darker above; margins usually serrate, slightly recurved 6
- 6 Leaves narrowly lanceolate, narrowly ovate, obovate or oblanceolate, length: breadth 12–4.5:1, apices usually acuminate, mucronate or acute SE Qld, E NSW **D. silvestris**
6. Leaves broadly lanceolate, elliptic, ovate or obovate, length: breadth 3–2:1, apices usually obtuse to slightly acuminate. E Qld, NE NSW **D. bilocularis**
- 7 Adult leaves serrate or serrulate, sometimes obscurely so 8
7. Adult leaves entire 12
- 8 Ovary perfectly 3–5-locular; capsule depressed-globular or slightly obovoid; septa connate axially in fruit. E Qld **D. pittosporoides**
8. Ovary perfectly or imperfectly 3-locular; capsule ovoid; septa not connate axially in fruit 9
- 9 Capsule 2.7–5.5 cm long and walls 3–5 mm thick; style 1–1.5 mm long; lamina below thickly covered in waxy cuticle; petiole 5–13 mm long. Central Qld **D. megacarpa**
9. Capsule no greater than 2.4 cm long or walls no greater than 2 mm thick. 10
- 10 Style to 0.3 mm long; lamina 0.5–3 cm long; petiole 0.6–1 mm long. SE Qld. **D. parvifolia**
10. Style greater than 1 mm long; lamina ≥ 3 cm long; petiole > 1 mm 11
- 11 Style 1.2–1.7 mm long; pedicel 1.7–3 mm long; lamina 3–9 cm long and 1.1–3.7 cm wide, petiole 1.5–4 mm long; capsule 1.6–2.4 cm long. Cape York, Qld **D. peninsularis**
11. Style 2–2.5 mm long; pedicel to 1 mm long; lamina 4–12 cm long and 1–4.5 cm wide, petiole 2–5 mm long; capsule 1–1.7 cm long. E. Qld, NE NSW. **D. celastroides**
- 12 Valves of capsules coriaceous; septa at least partially connate or touching axially. NE NSW **D. moorei**
12. Valves of capsule woody; septa not touching axially. 13
- 13 Capsule valves 0.3–0.5 mm thick; petiole 0.6–1 mm long. SE Qld **D. parvifolia**
13. Capsule valves 0.9–5 mm thick; petiole 4–13 mm long 14
- 14 Filaments 0.5–1 mm long; style very short or obsolete; ovary with 6 ovules per carpel; capsule valves 3–3.5 mm thick. N NT, N WA **D. obscura**
14. Filaments ≥ 1.3 mm; style 0.4–1.5 mm long; ovary with 8–10, rarely 6, ovules per carpel 15

- 15 Pedicels 4–11 mm long; lamina with a thick waxy cuticle on the abaxial surface; inflorescence a complex cyme; capsule 2.7–5.5 cm long and 3–5 mm thick; petals 4–5 mm long. Central Qld **D. megacarpa**
15. Pedicels no more than 4 mm long; lamina lacking a thick waxy cuticle on the abaxial surface; inflorescence a simple cyme or raceme; capsule no greater than 4.5 cm long or 3 mm thick **16**
- 16 Petals 3–3.5 mm long; capsule ovoid, rarely obovoid, 15–28 mm long; inflorescence many-flowered. N & Central Qld **D. oleaster**
16. Petals 3.5–4.5 mm long; capsule fusiform or obovoid, 25–45 mm long; inflorescence 1–3-flowered. NE Qld **D. viridissima**

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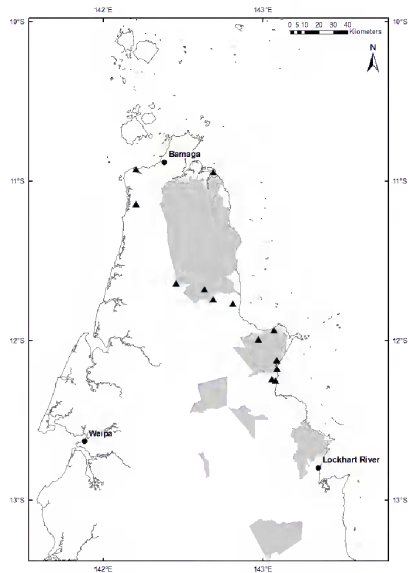
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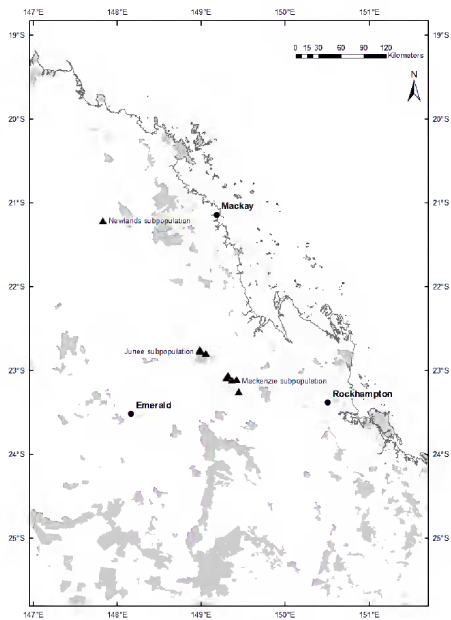
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Map 2. Distribution of *Denhamia peninsularis*.



Map 1. Distribution of *Denhamia megacarpa*.